THE

ADVOCATE OF SCIENCE,

AND

ANNALS OF NATURAL HISTORY.

VOL. I. PHILADELPHIA, FEBRUARY, 1835. No. 7.

GEOLOGY—No. III.

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My last number contained some observations on the general character of fossils, and their importance in connexion with the study of Geology. The distinctions on which the classification of rocks is founded, were also briefly stated, and the six classes in which the strata will be arranged in these essays, were named and defined. I will now call the attention of my readers to a more particular examination of the first of these classes, namely, the Primary or Primitive rocks.

General description of the Primary Class.—It has been already remarked that the rocks of this class are deepest in their situation, and appear to form the basis on which the strata of the other classes repose. In mountainous countries they are apt to appear on the surface, sometimes forming the body of the mountain. This arrangement of the primary formations was explained in the previous essay to be that which an eruptive force, acting from beneath, is calculated to produce. They contain no fossils, or in other words, no remains of animals or plants; neither do we observe in them any fragments of other rocks. Hence is derived the inference that they were formed prior to the existence of animal and vegetable life; and to this circumstance the name of the class refers.

Crystalline structure of the primary rocks.—These rocks are always more or less crystalline in their structure, showing that they were formed by *chemical*, and not mechanical agency; or that they were in a state of solution by fire or by water, previous to assuming a solid state. Were they the result of mechanical causes, they would have been composed of particles cemented together without any crystalline appearance. A familiar instance of the difference between a *crystalline* and a *mechanical* structure, is observed in marble and chalk, which are both composed of the same ingredients, crystallized in the marble, but adhering mechanically in the chalk.

Were the primary rocks formed by fire or by water?—This question involves a large amount of facts and arguments, of which more will be said hereafter. One class of geologists argue that they resulted directly from the refrigeration of the globe, which was once a mass of melted or inflamed materials. Another class supposes them, originally deposited by the ocean, and subsequently crystallized by the action of a central fire burning beneath. A third set of geologists, refer their formation immediately to the process of crystallization from an aqueous fluid, which once held their materials in solution; just as we observe alum or rock candy, crystallized from its solution in water. If any of my young readers choose, they may exercise themselves in deciding this important point, by applying the facts which have a bearing on the question, as I shall present them.

Extent of the primary strata.—That these rocks environ the whole globe does not admit of positive demonstration. But from their uniform appearance in mountainous districts in all parts of the world, we may infer with tolerable certainty that the primary strata, or some of them, compose the foundation rocks of every country; and that, where the surface is level, they repose at a considerable depth beneath, only presenting themselves to our view in places where they were protruded by the causes which operated in the formation of mountains.

Age of the primary strata.—I have said that the absence of all traces of animals and plants in these strata, has led to the conclusion that the primary rocks were formed prior to the creation of life—at a *day* when our planet was not in a condition

to support the existence of a single animal or plant. True, we have no means of ascertaining positively that they have not at some period, contained organic remains, which were destroyed by the same process to which the rock owes its present crystallized structure. We may infer, however, with sufficient certainty, that their formation preceded the formation of animal and vegetable life, because the strata next above them, and apparently next in age, contain almost exclusively the remains of the lowest orders of animals, which are considered as the first link in the great chain of created beings.

Granite, its situation &c.—The most important of the primary rocks is called *granite;* a name given to it because its structure is often granular, or composed of grains. It lies deepest, or nearest the centre of the earth—no other rock having ever been discovered beneath it. As before observed of the primary rocks in general, it forms the summit and central portion of many mountains; and it is seldom exposed to view except in such situations.

Composition of Granite.—Granite is composed of three distinct minerals, blended together in various proportions, viz; *Quartz, Feldspar* and *Mica.*

Quartz described.—Quartz is one of the most abundant of mineral substances. It is very hard, so as to scratch glass, and to strike fire with steel. Every body is well acquainted with some of the forms or varieties of quartz. When pure, it is composed almost entirely of a substance called *silex.* Flint, rock crystal, and white sand, consist purely of quartz or silex. In this form it is an essential article in the manufacture of glass. When tinged with iron and manganese in various proportions, it constitutes many beautiful and valuable minerals. Amethyst, agate, cornelian, jasper, are composed of quartz, colored with iron or manganese. Its uses in the arts and domestic economy are almost innumerable. Glass could not be made without it; the burr stone, which grinds our flour, owes its pulverizing power to quartz; the grindstone is formed of it; the mason employs it in his mortar; the stone cutter uses it in sawing his marble; the cook uses it in scouring her utensils and the house maid in scrubbing the floor; the sand which I sprinkle over

my writing, to prevent its blotting, is chiefly quartz; the handsome crystals on the mantlepiece, the brilliant stone in your sister's breast-pin, and the beads in her bracelet or guard-chain, are most probably little more than quartz.

Feldspar described.—Feldspar is not so hard as quartz, though it produces a slight scratch when rubbed over glass. Its color is mostly reddish or white. It may always be easily detected by its peculiar manner of breaking. If I break a small lump of it into twenty, or a hundred pieces, each piece will show a tendency to assume a particular shape—that of a rhomb or lozenge. It is composed in part of silex, with the addition of alumine, (the base of clay,) and some potash. Feldspar is also a very useful mineral in the arts, being extensively employed in the manufacture of *porcelain;* of which it is the principal ingredient.

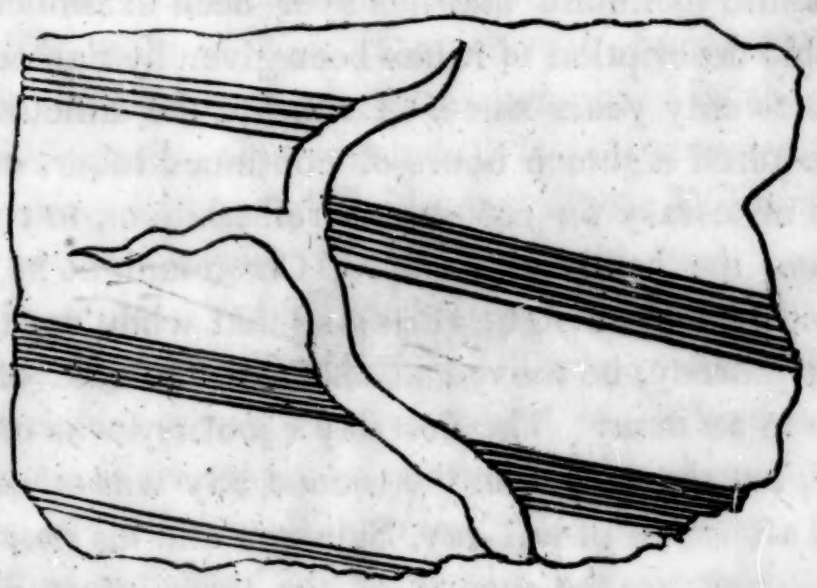
Mica described.—The third ingredient of granite is mica, often called isinglass. It is always separable into very thin layers, which are transparent and elastic; and it may be readily known from this circumstance. It is said that a piece of mica one inch thick, is separable into 300,000 plates. Mica is composed, like feldspar, of silex, alumine and potash; but these ingredients are very differently combined, so as to produce a very different mineral. The uses of mica are not so numerous and important as those of quartz and feldspar. It is often employed, however, as a substitute for glass, being found in some countries in very large sheets. In ships of war it has been thus used for windows, not being liable to injury from the concussion of the cannon. It is also well adapted for confining on the slides of the solar microscope, insects and other objects, to be examined with that instrument.

One of the ingredients of granite often wanting.—The proportions of these three minerals, in the composition of granite, are subject to great variation. It often happens that one of them is entirely wanting, and the rock is then formed of the remaining two. Mica is most frequently deficient; but this deficiency improves the quality of the rock, for most of its useful applications.

Graphic Granite.—The granite is occasionally blended with the feldspar in such a manner as to present, on the fractured

surface of the rock, a rude resemblance to Hebrew characters. To this variety, the term *graphic* is applied for a reason which my readers will easily discover. Graphic granite occurs principally in veins.

Granite Veins.—Veins of granite are of frequent occurrence, intersecting the other strata in various directions. The annexed figure will give a clearer idea of a mineral vein than can be conveyed by description merely. The body of granite is represented as sending up a vein in the form of a perpendicular wall, cutting through the superincumbent rocks, and giving out smaller veins in its course. This may be considered as an illustration of mineral veins in general, which are by no means confined to granite.



Granite not a stratified rock.—Granite differs from most other rocks in not being stratified. Instead of existing in distinct layers, it forms a mass or masses, having no regard to regularity of position.

Its relative situation not uniform.—Granite, though generally found beneath all the other formations, sometimes occurs resting on other rocks, in such a manner as to indicate that those rocks were formed prior to the granite. Facts of this character have led some geologists to the conclusion that granite has been formed at several distinct periods of time.

Scenery of granite countries.—Granite being a rock not easily disintegrated, the countries in which it prevails is generally mountainous, rugged and sterile. The aspect of mountains of granite is extremely various. Their summits are sometimes rounded, heavy and unpicturesque, and in other cases they resemble a mass of ruins piled confusedly together. Every body has read something of the scenery of the Alps, which consist principally of granite. In the vicinity of Mount Blanc, it forms lofty pyramidal peaks or *needles* as they are termed, which rise in enormous spires. One of these *needles* stretches nearly to a point in one solid shaft, more than 4,000 feet high; and the pinnacle of this spire is 11,000 feet above the level of the sea.

Ascent of Mount Blanc, by Saussure.—Mount Blanc is the highest granitic mountain that has ever been examined. The only valuable description of it has been given by Saussure, who ascended it twenty years since. Owing to the difficulty of the ascent it required eighteen hours of continued labor, exclusive of the time necessary for repose and refreshment, to reach the summit, from the beautiful valley of Chamouni, at its base, a distance not more than eight miles; so that while our traveller was on his journey, he moved at the average rate of nearly half a mile in an hour. The first day's journey was comparatively easy, but the ascent on the second day was on snow and ice. In the afternoon of this day, Saussure and his companions pitched their tents on the second of the three great plains of snow they had to traverse. Here they passed the night, 3,100 yards above the level of the sea, and 200 yards higher than the peak of Teneriffe. The barometer stood at seventeen inches, thirteen inches lower than the common measurement of our atmosphere. The next morning they proceeded with much difficulty and fatigue, arising principally from the extreme rarity of the atmosphere, which impeded their respiration, and reached the summit at eleven o'clock. Here they were on the highest point of land in Europe, and in all probability were at this moment farther from the centre of the earth than any other human beings. They were two miles above the line of perpetual frost and snow, and although far beyond the reach of

clouds, and exposed to the full splendor of an unclouded sun, the prospect around them was cheered by no plant or animal; not a single living thing besides themselves did their eyes behold.

Summit of Chimborazo volcanic. Although Chimborazo is more than a mile higher than Mount Blanc, yet granite is not found at so great a height upon it as upon the latter mountain. The tops of the Andes are composed of volcanic products, that have been ejected so as to cover the granite, and add greatly to their height. The summit of Chimborazo is a vast cone, composed, according to Humboldt, of regular and immense columns, which strike the eye of the traveller like the ruins of enormous castles lifted into the sky.

Granite in the United States.—This rock is met with in several parts of the United States, more especially in New Enggland. The state of New Hampshire is frequently called the *granite state*, owing to this circumstance. In the Alleghany mountains, granite also abounds. It is extensively quarried within a short distance of Baltimore. Near Wilmington, Delaware, it occurs in veins, from which large quantities have been removed for the sake of the feldspar, and shipped to England for the manufacture of porcelain. The porcelain manufactory in Philadelphia, the only establishment of the kind in the United States, derives its supply of porcelain from this source.

Origin of granite—Wernerian and Huttonian theories.—I have before remarked that granite is supposed by one set of geologists to be the effect of the action of fire. By another portion, it has been attributed to crystallization from a state of solution in water. The latter theory was adduced by the German philosopher, Werner; and the leading advocates of the former, were Dr. Hutton and Professor Playfair, of Edinburgh. As Werner was so much afraid of fire, and Hutton was not able to make the world without it, these rival theories have been respectively named after Neptune and Pluto, the former being, according to heathen mythology, the proprietor of the ocean, and the latter having charge of the land and the regions of fire. And geologists are ranked as advocates of the Plutonic or of the Neptunian theory, accordingly as they re-

gard fire or water to have been the principal agent in producing the present condition of our globe. There are, however, but few philosophers at the present day who do not attribute to igneous action most of the great rock strata.

Importance of facts in examining these theories.—The merits of these two theories will furnish an interesting subject of inquiry at a future period. In the mean time, as nearly every fact in relation to the strata may be brought to bear on the question, my readers would do well to consider, as we proceed, whether the facts are better explained by the watery or by the igneous doctrine: or in case of the failure of both of these, they may invent some other mode of accounting for geological phenomena, and propound some new theory of the earth.

Argument founded on granite needles.—To illustrate my meaning I will offer a few examples. The advocates of water present to their opponents the *needles* of granite, just now described, and challenge them to account for their origin by any convulsion of nature produced by fire; whilst themselves see an easy solution of the problem, in the peculiar manner in which crystals are known to shoot out in a saline solution.

Argument founded on mineral veins.—The phenomena of mineral veins are seized with avidity by both parties, to support their favorite doctrines. The Wernerians suppose these veins to have been filled from above, by liquid materials poured into crevices, which the drying and consequent contraction of the strata had produced. But the Huttonians say, the cracks were caused by the action of fire underneath, and the rock solution was subsequently thrown up into these fissures from the melted mass below. I shall show in the sequel that both these processes have been employed in the formation of veins.

Argument founded on hot springs.—Hot springs abound in many countries, especially near mountains and volcanoes. The Geysers, or boiling springs of Iceland, are the most remarkable in the world. Warm springs are common near the Andes, and they also occur near the Alleghany mountains in the United States. In the vicinity of the Alps and Pyrennees they are abundant, the temperature of their water varying from 94° to 126°. These facts are adduced by geologists of the Huttonian

school, to prove a reservoir of heat in the earth, and indirectly to establish the doctrine of the igneous origin of granite.

Argument founded on the resemblance of some granites to trap. Some varieties of granite are so nearly allied to trap and basaltic rocks, that it is impossible to establish the precise distinctive characters of each; or, in geological language, the two rocks pass into each other by insensible gradations. Hence a similarity of origin is inferred. As trap and basalt are now almost universally admitted to be igneous rocks, it follows from this argument that an igneous origin must be allotted to granite.

Architectural uses of granite, and its durability.—When granite contains little or no mica, and the other ingredients, quartz and feldspar, are intimately blended, in small grains, it constitutes one of the hardest and most durable rocks for the purposes of architecture. The Bunker's Hill monument, and many edifices in the United States, are formed of this material. The Ionic columns of the Roman Forum, the obelisks and many others of the most celebrated structures of Rome consisted of granite, brought from Egypt. Of the same material are the principal number of those stupendous monuments of tyranny and ambition which stud the plains of Egypt—monolithic and other temples, statues, obelisks, and pyramids, on which the hand of time has made scarcely a visible record in the lapse of twenty centuries.

Soft granite.—In Cornwall, England, is a singular variety of granite, which is soft enough, when first taken from the quarry, to be easily sawed into slabs; but on exposure to the air, it soon becomes very hard. Some kinds of limestone exhibit the same remarkable property. It is doubtless owing to the peculiar action of moisture.

In my next number I will introduce the remaining rocks of the primary class.

NOTES ON THE CHARACTER OF MINES.

By Thos. G. Clemson, former Professor of Chemistry in Paris, and Student in the Royal School of Mines, &c.

A MINE is a mass of mineral substance buried in the earth or existing at its surface, which by proper management may become a source of wealth. It is not uncommon to hear a mine spoken of as a treasure, without considering the probability of its extinction before the necessary expenses attendant on the undertaking are defrayed. The result of labor is uncertain, owing to the constant variation and unavoidable obstacles which so frequently occur in nature. These can only be overcome by a very large capital judiciously applied, so that the proceeds of the mine when yielding largely, shall establish a fund to meet the expenses when it is worked at a loss; for the history of a mine shows a series of fluctuations, sometimes as far above as at others short of the expenses which are incurred in working it. And there are but few so prolific as to be in full operation for any number of years, without the assistance of such a fund.

If we were here to stop for a moment, and reflect upon the multiplicity of uses to which the metals are employed, in all the operations of life, we would be better able to appreciate the great value of a mine. The extraction of its contents from the earth, their ellimination for the uses of the different arts, and the manufacture of the same, may support an entire population; and that, in a locality where the soil refuses to repay the labors of the husbandman, or is otherwise unfitted for the existence of man. Switzerland offers examples of whole towns being employed in manufacturing a few pounds of iron; we will not be surprised at this fact, when we consider that there is no substance which increases more in value while undergoing the manufacturing process; one pound may be so shaped as to be worth twenty thousand dollars.

If we look to England, without biassing our judgment by the eloquent discourses of distinguished statesmen, or with the writings of erudite economists, we will infer that her mines of

coal and iron are the causes of all her greatness. Had it not been for the coal which underlies the soil, her manufactures would never have existed; the transportation of this production to different parts of the kingdom, and to other countries, gives employment to many of her seamen.

The iron after being manufactured, is sent to the coast on rail roads or through canals, from whence it is shipped to all parts of the world. Nor is this enterprising nation contented with the riches that her own earth gives out; the ores of different parts of Europe, of North and South America, here met together in the same crucible. That great activity which prevails in the environs of the coal deposits of England cannot be described: it is in visiting these scenes of human industry which are to be seen at Birmingham, Manchester, Sheffield, Tydville, &c. that such invaluable gifts of nature can be duly appreciated. If ever you visit Great Britain leave for a moment the beaten track of those who seek excitement before the gildings of a palace or the vaulted columns of a delapidated cathedral, and bend your steps towards one of those vast institutions of industry. Pay a tribute of curiosity to their elegant bazaars, where objects of the greatest diversity in taste and convenience are exposed to view; where the most accomplished artists portray their talents of exquisite workmanship; then examine in detail some of those pieces of mechanism which at first sight appear intricate, but on mature acquaintance become models of simplicity and use; some of those inventions that have revolutionized the arts; placed in the hands of the most indigent objects once owned but by kings, or a few privileged rich. And when wearied with the clattering music produced by the active population of this large city, in shaping iron into the varied forms, from a needle to a steam engine, wander on the heights that overlook Dudley; the remembrance of fœdal tyranny will amuse you while running over the mouldering battlements of the castle, once the pride and strength of a noble lord.

As evening approaches, the furnaces present a more imposing aspect; as far as the eye can reach every thing is fire; the horizon, the earth, the heavens, are one magnificent illumination, in

vain would you compare it with other sights. The originality, the sublimity of the spectacle rivets you to the spot, and in your amazement you ask if this can be the work of man.

A mine then is an exceedingly precious and delicate source of those objects which nature has given to man, to be drawn upon in need, in no wise to be be squandered or rendered useless by posterity; but it should be handed down from one generation to another. Hence it becomes the absolute duty of every nation to prevent their ruin by all the means which lay in its power, to keep at bay the avarice, inexperience and knavery of ignorant speculators; for this kind of enterprize, more than any other, stands in need of a particular kind of knowledge, in no wise intuitive or easily acquired; an economy and disinterestedness beyond the life of a generation is also necessary.

In former days when the nations of Europe were young and civilization less advanced, mines were naturally abandoned to the caprices of the proprietors of the soil, and their conservation dependent on individual interest; the landholders possessed the power of unbounded use and abuse over all the mines. This is a simple conclusion and the reasoning holds, whether from a want of experience, as to the good or bad results arising from liberty without restriction, or want of force in the governing principle.

The annals of mining show the absurdity and insufficiency of this doctrine, to insure their conservation. Independent of the disasters of which examples are too frequent and which have been created by this order of things, there exists no conformity of disposition between the surface as it is usually divided, and the deposits of minerals found in the bosom of the earth; their very manner of being is irregular and only susceptible of division after a certain manner, which is entirely different from the considerations that have led to the division of the surface, and as Mirabeau justly said in the last of his eloquent discourses, "That legislator which admits two kinds of property as accessories the one to the other, one of which would be useless inasmuch as it has the other for base and measure, would be absurd."

It is frequently necessary to commence a mine at some dis-

tance from whence it crops out, or the proprietor after having gone to great expense to sink a shaft and organize operations may find that the vein changes direction under the property of another individual, who thus profits at the expense of justice; or the works of one may be submerged by the want of method in his neighbor's diggings—questions of this nature have given rise to endless disputes, which cannot be settled by the simple laws of equity. The interminable arguments between the proprietors of the mines of Rive de Gier, Dept. of Loire, is one of a thousand happy illustrations that here be adduced, to prove the unfavorable effects that result from the mode of extraction always employed by those who are the entire possessors, without restriction, of a deposit; as also of the necessity of particular laws, and the application of the principles of the science at the very commencement of an exploration. The above locality is celebrated for its coal mines which have been worked for years. A number of shafts have been sunk in a lower part of the basin, than others. Those that first commenced extracting carried of that part of the coal which was nearest the surface, or the most apparent, without any regard to economy or future advantage. By this means the different masses were loosened, causing slides, passages, &c. so that in a very short time it became impossible to impede the progress of water from one mine to another, and particularly from the most elevated. The owners of the lower mines finding themselves burthened not only with the water that accumulates in every subterranean excavation, or their own, but with that of the other mines above them, which gained its way through the fissures as above mentioned, and becoming so abundant as to threaten to stop their operations; those interested in the upper mines, refusing to cooperate with the proprietors of the other works in extracting the water, the latter had recourse to justice. Things thus pending and expenses increasing in a two fold ratio as the mines increased in depth, a cessation of operations in the lower works was the issue; as the water accumulated it submerged in their turn those that had been previously drained. The heretofore defendants now took the precedence at the former; the cause having been frequently tried before different tribunals, the laws

of equity were declared incompetent to arrange the intricate questions that arose. The government has interfered, and named a committee of engineers who are to make such regulations as that the whole number of mines shall be named, and the expenses proportionably divided between those interested. It is endless to enter into detail to show the great advantages and economy that a like measure would have occasioned, had it been executed at the commencement of operations.

The large sums necessary to commence opening mines exceeds the means of each of the proprietors of the surface, and it is not only dangerous to the agricultural interests, but also to the mineral riches of a country, to permit the proprietors to dig or work without limit; for in matter of mines, individual interest is in direct opposition with that of the public. In one case art requires the workings to be carried to as great a depth as possible; whereas in the other, momentary interest and the want of capital causes the proprietor to carry off that part of the mineral which is the most evident or most easily loosened, and superficial perforations as has been stated cause slides, which together with the ingress of water prevent the extraction of that portion untouched below; thus forcing the abandonment of their unskilful operations. And it is owing to this unlimited power that in many parts of the world the superfices of the soil for a considerable distance around has been perforated with holes, thus rendering the interior inaccessible either to talent or means. The surface devastated by ravines and precipices, in fine it is the shortest and surest method that a nation can take to insure a perfect wreck of the interior mineral wealth and the superficial agricultural soil, for it is utterly impossible that one can here know his interest without long and laborious study of a particular kind.

Europe, and in fact every country where there exists mineral deposits that have been worked, offer examples of the ill effects that have arisen out of the system of considering mines as private property. In Germany where the science and practice of mining approaches nearest perfection, it is a truth well known that the only places that mines have been rendered unfit for agriculture, are precisely those where the proprietors had the lib-

erty to multiply their inconsiderate diggings, to tear and lay waste the soil and thus prevent the after use of that which was not extracted, but rendered inaccessible.

The prodigious catastrophes that have taken place at Altenberg and Geyer in Saxony, at Shlackenwald in Bohemia, are sad examples of the inefficiency of private interest, and the necessity of laws not only to secure the utility of mines, but to prevent their ruin and the desolation of the surrounding property. At the first of the above named places, there exists a tremendous gulf six hundred feet in diameter, and nine hundred in depth: the work of ignorance and unlimited power.

The coal mines of Liege in Belgium, having been anciently worked in the unphilosophical manner alluded to, presents an example to the point. The old excavations were filled with water so that their extent were unknown. And when new workings were commenced and continued to a considerable depth, the laborers approached within a short distance of the old ones, when the pressure of the water was such as to force itself through, destroying both the works and the workmen.

An eruption of this kind, celebrated by the circumstances that accompanied it, occurred in 1811, and others since; in Mexico also similar accidents have transpired. The miners, to prevent as much as possible these melancholy effects are under the necessity of preceding their works, by boring in several directions, which very much increases the expense of the coal, without being a perfect guarantee for the lives of those who may be employed in the mines. The art of mining teaches us to prevent these cruel accidents and many others of a different, though not less serious nature. It must then be called a humane art.

The above coal basin is prolongated and passes by Charleroy, Mons, Valenciennes, on to Eschweiler; at this locality it contains a number of coal measures, which were once worked without any regular system, and above all without any future considerations of economy; in general the layers of coal were sought by pits of little depth, abandoned and others commenced as soon as the coal in the immediate vicinity was carried off; by this very reprehensible mode of exploring the soil of the

coal basin of Eschweiler was perforated with a multiplicity of superficial orifices through which the water would flow, and thus frustrate all the efforts that would be made to continue the old works. Things in this state, the engineers who desired to render advantageous the immense riches that lie buried in the depth of the coal basin, were forced to sink their shafts to the strata of coal which lie at a very great depth, and to leave untouched between the new and old works, as also in every strata a mass of coal of one hundred feet in thickness. This was the only possible mode that could be designed to prevent the water existing in the superficial pits from inundating the new works, which will cause as is seen, a loss of a considerable part of the coal, annihilated for society by the improvidence of the first explorers.

The rich and productive copper mines of Anglesey is an example, where the proprietors of the soil in a few years turned and excavated the surface, so that it almost became impossible to carry on the operations; in this case the abundance of water, together with the frequent slides, caused such serious embarrassments, as to make it a question whether the total ruin of this rich deposit would not be the consequence. Examples of valuable deposits having been much injured by want of method, or through ignorance, are not wanting in our own country; we refrain from citing localities from motives of delicacy.

Upon this interesting subject we have the experience of nations for ages past. The talent of those enlightened by unbiased study and example, their profound reflection, and mature consideration give the result. That sources of wealth of such major necessity would be in eminent danger, if declared the property of individuals respectively; and that all mines should in the nature of things be considered as public property, and placed under the safe guard of express and particular laws, and disposed of according to the interest of society, for no individual should have the power to destroy either by will or ignorance, that which belongs to the community; or to oppose the advancement of general interest by possessing the *plena potus* over that, the sole fact of which would be detrimental to society and out of the means of his own enjoyment. The con-

siderations which have led to the discussion of this important question, had not their origin among those who were possessed of the power to make innovations on private property. The most able counsellers have declared mines to be a part of public property: that as public necessities are supplied from them, so public claim is in accordaace with the laws of nature; hence the *droït regalien* in France—Royalty in England—*Berg Regal* in Germany, &c.

Droit regalien in France, gives to the state the right to reserve and dispose of subterranean wealth, as public property, independent of private property, existing at the surface. This right is limited by the liberty of mines, (*liberté des mines,*) (*Berg freyheit*) or the right granted by the state to private individuals, to explore mineral substances, either under their own ground or that of others, conforming to certain precise conditions, which when enacted, prevent the ruin of the mineral riches, and agricultural soil.

The object of the first is that all mining operations should be encouraged, regulated and protected by the state, thus to insure to every one success and the enjoyment of the fruit of his labor; of the second to grant every one permission to work in conformity to certain laws, which have been enacted for the good of society, and thus to insure particular interest without injuring that of the whole, wherever the means are offered, either under the property of the one exploring or that of others.

The most superficial observer will perceive the marked contrast that exists, always to the advantage of that district, where a correct legislation is wisely administered. In passing let us take a cursory view of that classical ground for the mineral sciences, known as the Hartz Gebrige. This isolated group of mountains rises out of the centre of the vast plain of the north of Germany. Its latitude and elevation makes its winters long and cold. The thermometer of Reaumur varies from 25° to 35;° from November to May, the Brocken, here the highest point of land, is covered with snow. There is no spring; even during the summer the inhabitants keep fire. The thick mists that are hanging heavily about, or hurried on by the chilling winds

keep every thing humid or wet, preventing for months the enlightening rays of the sun from reaching the earth. The climate is as inhospitable as the soil is ungrateful; not one of the cereals is cultivated, the potato scarcely comes to perfection. The verdure is stunted, and wants that lively appearance that so characterizes a luxuriant growth. Still in climbing the rugged heights as the curious traveller is pleased to do, the tinkling of the cowbell is occasionally heard, enlivening the mountain stillness with a kind of charming melody. The animal partakes of the meagre growth of the herb. A little dairy and a few potatoes are the only agricultural commodities of these highlands; for the other aliments the population is indebted to the lower and less ungrateful surrounding country—whence they are carried up at considerable expense.

The romantic scenery, and other monuments of nature, together with the mines, metallurgical works and splendid hydraulic constructions, draw hither a number of strangers during the summer months; but there is scarcely one that would not shrink back upon himself at the idea of a life's residence. Still fifty thousand sturdy, happy, honest souls inhabit this district, and every one either directly or indirectly is engaged in the mines, for no one is allowed to settle in a mine city (Bergstadt,) without previously proving his connection therewith; inured to hardships from their infancy, privations become part of their existence, and when the inhabitant of these mountains descends into the plain or leaves his native land, "at each remove he draws a length'ning chain." If we examine the history of one of the numerous mines that are here worked, or that have been explored for years gone by, and which are the only support of this good people, we will find the truth of this remark to hold good, viz: a mine is nothing if an administration be wanting. In 1807 in the districts of Andreaskerg and Zelerfeld there were fifty-six mines in activity, and out of this number only six gave a product that exceeded their respective expenses, four were without loss or gain, and of all the rest, the expenses individually exceeded the product. If we were to advance that there are no mines whose product would cover expenses, we would be reasoning against assent; but the same natural cir-

cumstances on either side, that mine that could not exist were its activity dependent on its nett proceeds, would become an immense object of industry in the hands of a proper administration. The same holds good though to a much greater extent, and the advantages are multiplied, where a number of mines are explored to a common end, as is observed in many parts of Europe as well as in the Hartz. The colossal artificial works, the immense capital yearly created, and various other advantages would never have existed, were it not for the admirable administration here employed.

The great end of all the works in the Hartz is public utility, and every thing ordained to meet this purpose; to base upon sure an l solid principles the existence of that, which if left to private individuals, would lead to their own ruin and the ultimate destruction of the object itself; to replace ignorance, *charlatanism*, and the cupidity of a few speculating capitalists, by wisdom and experience, without enriching a few at the expense of the whole; to make of a lottery an object of reasonable success, in which the public may have hope and confidence.

The object is not to enrich the speculator, but to restrain him from prosecuting measures which would sacrifice his capital, thus his money is directed to a profitable and certain source; gives a steady, in the place of fluctuating employment to a large number of laborers, and throws into circulation an immense capital. Many other advantages are derived by extending this policy over the operations of mining districts.

Every thing respecting the mineral kingdom of this country is submitted to a council of mines, which holds its sittings at Elausthal, where there is a school of mines of celebrity, an institution essentially necessary to every nation that desires to reap the greatest advantage from her mines; no new mine can be opened without the consent and inspection of the council. The field here granted to a company to explore, (*Das feld ciner werk scaft,*) is a length of near 650 feet, measured at the surface of the earth upon the direction of the vein, and about 42 feet larger than the breadth of the same. This manner of restricting the workings of each particular company to a small

extent of surface is followed by the happiest results. Those working find it to their greatest interest to sink their shafts as deep as possible, which is in conformity with the rules pointed out by science and the interests of the public. The whole number of mines are divided into those that are explored at a loss, and those whose product surpass the expenses; from the latter the nation receives a portion of the income which is applied to the support of those which are loosing. No money is distributed previous to the formation of a sum which is kept in reserve to come against its own expenses when in need, or to be lent to other mines which have occasion for aid. The constitution of the laws are such that the nation cannot reserve an *alodus* from any mine, without all of the mines, &c. are in a prosperous condition; whereas the stockholder is sure of receiving his portion of the product of the mine in which he may be interested, no matter what the state of the others may be at the moment. A nation is amply remunerated by the great advantages that are derived from the existence and indefinite activity of a number of vast and variously useful establishments, without a pecuniary income, which is far from being the main object of a country which alone possesses the power to carry on for a long time and without pecuniary aid, the working of mines and carrying into effect conceptions, the perfecting of which is beyond the means and existence of man.

For a more concise view of the Hartz Mountains see Silliman's Journal, No. XXIX.

***Meteorological Summary for each month of the year* 1834, *and General Summaries for the years* 1833 *and* 1834. Kept at Wilmington, Delaware.**

	THERMOMETER.									BAROMETER.						DAYS					RAIN & SNOW.			DAYS.				
	Mean at sunrise, . . .	Mean at Mid-day, . .	Mean at 11 P. M. . .	Mean of two observations	Maximum	Minimum	Range, ...	Warmest Day, ...	Coldest Day, ...	Mean at sunrise, . . .	Mean at Mid-day, . . .	Monthly Mean, ...	Maximum, ...	Minimum	Range, ...	Proportion clear days.	Proportion cl'dy days.	Whole days clear, . . .	Days of Rain, ...	Days of Snow, ...	Quantity of Rain, . . .	Quantity of Snow, . . .	Quantity of Water, . .	Northerly Winds, . . .	Easterly Winds, ...	Southerly Winds, . . .	Easterly Storms, . . .	Electrified clouds, . . .
Jan.	23.840	33.870	26.420	28.855	56	8	48	53.0	14.0	29.985	29.974	29.980	30.48	29.35	1.13	13	18	5	5	6	2 65	7¼	3.54	14	8	9	7	0
Feb.	33.920	46.500	37.320	40.210	67	18	49	55.5	25.0	29.897	29.869	29.883	30.38	29.60	0.78	14	14	8	4	0	2.25	0	2.25	7	11	10	3	1
Mar.	35.130	51.190	38.480	43.160	74	20	54	65.5	27.0	29.966	29.917	29.940	30.50	29.54	0.96	19	12	10	9	0	3 16	0	3.16	12	8	11	3	2
Apr.	44.430	61.100	47.630	52.765	83	29	54	68.0	37.0	29.833	29.823	29.828	30.37	29.40	.97	17	13	9	12	2	5.50	½	5.54	9	12	9	5	4
May	50.060	69.870	53.450	59.970	85	28	57	74.5	40.0	29.830	29.877	29.823	30.24	29.49	.75	18	13	10	9	0	5.92	0	5.92	7	11	13	2	8
June	61.230	77.130	64.000	69.180	88	50	38	78.0	60.0	29.730	29.724	29.727	30.00	29.37	.63	19	11	11	13	0	9.92	0	9.92	12	7	11	3	12
July	69.130	84.480	72.390	76.855	93	58	35	84.5	68.0	29.880	29.875	29 878	30.20	29.70	.50	21	10	14	10	0	7.89	0	7.89	9	6	16	3	22
Aug.	65.260	81.970	68.680	73.615	92	56	36	83.5	66 0	29.823	29.818	29.820	30.03	29.61	.42	24	7	18	3	0	.65	0	.65	12	10	9	0	8
Sep.	58.230	70.530	60.030	64.380	85	37	48	76.5	50.0	29.927	29.921	29.924	30.36	29.60	.76	15	15	9	12	0	6.76	0	6.76	9	12	9	6	6
Oct.	43.520	58.130	46.480	50.875	79	29	50	72.5	37.5	29.923	29.903	29·920	30.36	29.56	.80	22	9	15	7	0	2.90	0	2.90	15	3	13	0	2
Nov.	35.130	46.370	37.833	40.750	56	21	25	49.5	26.0	29.857	29.843	29.850	30.24	29.55	.69	15	15	5	7	3	3.32	4	3.75	17	5	8	3	0
Dec.	29.770	37.020	29.420	33.400	51	6	45	50.0	12.0	29.900	29.870	29.910	30.31	29.35	.96	12	19	4	8	4	1.84	11	3.11	12	10	9	4	0
1834	45.804	59.847	48.511	52.830	93	6	87	84.5	12.0	29.879	29.863	29.874	30 48	29.35	1.13	209	156	118	99	15	52.76	23	55.39	135	103	127	39	65
1833	46.307	58.850	50.208	52.578	90	4	86	82.5	14.5	29.835	29.820	29.830	30.35	29.08	1.27	214	151	145	97	12	54.92	25	58.10	129	110	126	50	45

Auroras. Four auroras were observed in 1834, viz.: 1 in July, 1 in Nov., and 2 in Dec. In 1833, 8 were seen.

GENERAL OBSERVATIONS ON THE YEAR 1834.

Made at Wilmington, Del.

The winter of 1833 and 1834 was a moderate one, the cold weather being confined to the month of January. Although there was no intense cold, the lowest temperature being 8°, yet the Brandywine and Christiana rivers were frozen up at two distinct periods, and the navigation of the Delaware at the same time was prevented. Between the two *spells* of cold, was an interval of ten days of warm weather, which dissolved the ice, and left the navigation of our streams unobstructed. But winter returned with a snow storm on the 20th of January, and after a reign of ten days, abdicated in favor of spring. The pleasant weather that ensued was celebrated by the frogs, about the middle of February, and in a few days more produced a sensible effect on vegetation.

In the three winter months rain fell on twenty days, and snow on nine. There were 12.70 inches rain, and 13½ snow, making 14.44 of water. Northerly winds prevailed in the proportion of thirty-seven days, easterly thirty, and southerly twenty-three. Easterly storms were frequent though not generally severe.

The spring was characterized by a temperature varying from unseasonable heat to extreme cold. Each of the spring months had its summer and its winter, mixed up in such a manner as to render the season exceedingly unpleasant, and also to destroy almost entirely, the important fruits. On the 15th May, the thermometer stood at 28° at sunrise, a degree of cold almost unprecedented for that time of year. Except in the beginning of April, and in the beginning and end of May, there was little rain.

In the three spring months rain fell on thirty days, and snow on two days, both of which were late in April. There were 14.62 inches of rain, and about half an inch of snow. Northerly winds prevailed twenty-eight days, easterly thirty-one, and southerly thirty-three. Easterly storms were frequent.

In the summer months the temperature was unusually regular, being in this respect the exact counterpart of the previous portion of the year. Our summers are seldom so uniformly

warm, and accompanied with so much *hot* weather as that of 1834. July and August were also remarkably dry, so that vegetation suffered almost as much from drought as it had before from the unseasonable frosts of spring. A rain of unexampled magnitude occurred on the 29th of July, after a series of very hot days; five inches fell in less than two hours and a half. Electrified clouds were very frequent. This summer was also a hot one in England.

Rain fell on twenty-six days, half of which were in June. There were 18.46 inches, of which less than one inch fell in August. Northerly winds prevailed thirty-three days, easterly twenty-three, and southerly thirty-six. Easterly storms were not frequent.

The autumn was seasonable and pleasant, though attended with a greater quantity of cold weather than common. The first hard frost which put a stop to vegetation was on the 15th of October. November was marked by a snow storm of the real wintry stamp, on the 15th and 16th; the weather about that time being very cold for the season. At Quebec the thermometer sank to 8° on the 16th.

In the autumnal months rain fell on twenty-six days, snow on three. There were thirteen inches of rain and four of snow, making about thirteen and a half of water. Northerly winds prevailed on forty-one days, easterly on twenty, and southerly on thirty. Easterly storms were not unfrequent.

The month of December exhibited nothing remarkable except an unusual fall of temperature on the 14th; the thermometer sank from 40° at sunrise to 8° at 11 P. M. Seasonable weather followed, and on the 28th a deep fall of snow ushered in a non-descript winter; the history of which belongs to the year 1835.

The mean temperature of the whole year, as the table shows, was nearly 53°. The average yearly temperature of our climate is about 52°, so that the year 1834 was considerably warmer than the mean. Indeed since the year 1831, there has been a gradual increase of temperature yearly; the average of that year was only 51°, which is unusually low. The three

succeeding years averaged 52°, 52°58, and 52°83, respectively.

The quantity of water which has fallen in the past year is worthy of remark; it amounted to upwards of 55 inches, which is probably from 6 to 10 inches above the average quantity. The last five years have averaged within a fraction of 58 inches, and have therefore been *wet* years. It is probable, judging from this circumstance, that several succeeding years will be dry. It should be observed, however, that more rain has fallen at Wilmington, for several years past, than there appears to have been in most other places in adjacent states, where records have been preserved.

QUERIES.

To the Editor of the Advocate of Science,

Sir,—Formerly I was much interested in the queries and answers which some of your correspondents dealt out to each other; of latter times, your most active querist appears to have had her curiosity satisfied; which, to say the least, is odd enough for one of her sex. I hope you will not judge of *all* of our gender from her, and think that we have no interest in matters connected with science. Often do I feel an itching after some of your *scientific solutions*, to matters and things which come under my observation; and I send you two or three questions, enjoining upon you at the same time, the necessity of keeping clear of all your jawbreakers while answering them.

1. What was the origin of balloons, and what useful purpose has ever been accomplished by them?

2. How do those who ascend in them, ascertain the height to which they rise, by means of the barometer?

3. Why is it that the air becomes colder as you ascend from the earth.

I suppose these are about as many as you wish to have at once; but being true to the nature of a girl, I have enough to ask to keep you answering for months to come; you may therefore look out for more.

BARBARA'S COUSIN.

We are glad that the cousin of "Barbara" has manifested that laudable species of curiosity which is gaining an influence over the minds of her sex. It is impossible to say why our correspondent has been so quiet; she must speak for herself. Her cousin is assured that no "jawbreakers" will be exhibited to view by the writer who attemps to solve the queries. We thus warn whoever undertakes the task, not to give offence to her ladyship by so doing.

PROCEEDINGS OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA.

Jan. 6th, 1835. Dr. Jay presented a valuable collection of shells, mostly from India.

Jan. 13th. The corresponding secretary read a letter from Dr. John C. Jay, of New York, accompanying the shells presented at last meeting.

Dr. Morton stated that he had received a letter from Mr. Mantell, informing him that a number of the American fossil shark's teeth figured in Dr. M.'s "Organic Remains of the Cretaceous Group of the United States," had also been discovered in the chalk of Europe, thus identifying another series of animals as common to the equivalent formations in England and the United States. The species in question are *Galeus pristodontus, Lamna acuminata* and *Lamna Mantelli.* In the same strata, are found the remains of two extinct species of fishes, viz: *Saurocephalus lanciformis,* and *S. Leanus.*

Jan. 20th. Dr. S. G. Morton presented a specimen of *Cytherea,* from Madras, and one of *Cypræa hirundo,* from India.

The corresponding secretary read a letter from Mr. Torbit to Dr. Swain, of Bristol, stating that a quantity of bones had been found in the neighborhood of Durham Pa., in the fissure of a limestone rock.

These bones are not strictly in a fossil state, although some

of them are infiltrated by calcareous matter. From additional information it appears that nearly a cartload of these remains have been removed, belonging to the deer, raccoon, squirrel, and some other quadrupeds not yet identified, together with some vertebræ and scales of fishes. It seems probable that this fissure in the rock has been the den of carniverous animals, and that the bones in question are remains of their prey. This subject is in course of further investigation.

Caverns of the foregoing character are not unusual. They abound in the limestone formations of many countries: and as this is an interesting feature in geology, our readers will be presented with a few illustrations to the point. In relation to the bone caverns of Germany, Cuvier observes, that nothing is more truly curious. Numerous grottoes, brilliantly decorated with crystalline stalactites of every form, succeeding each other to a great extent through the body of the mountains, communicating together by openings so narrow that a man can hardly proceed by crawling on his hands, yet with their floors all bestrewed with enormous heaps of bones of animals of every size, form undoubtedly one of the most remarkable phenomena which the fossil kingdom can present to the meditations of the geologist, more especially when we consider that this scene of mortality is repeated in a great many places and through far distant lands. No wonder, then, that these vaults of death have become objects of research to the ablest naturalists, and that their bony relics have often been described and figured. Prior to such philosophical inquiries, however, these bones were famed among the populace; who, as usual, added many imaginary prodigies to the natural wonders which they had seen. The bones were long dug up and sold to the apothecaries as bones of the *fossil unicorn*, on account of some singular virtues which they were reputed to possess: and there is no doubt that this strange traffic contributed mainly both to the investigation of old caves and to the discovery of new ones.

The most anciently celebrated cavern is that of Bauman, in the Duke of Brunswick's dominions, in the district of Blankenbourg, to the south of a village of that name, in a hill which

forms one of the exterior slopes of the Hartz mountains, towards the east. The general direction of the cave is from east to west, but the entrance looks to the north, although it soon expands into an ample vault; the mouth is narrow, and can be entered only by crawling. The first cave is the largest, from which there is a descent into the second of thirty feet, at first by a narrow gallery through which we must creep, and then by going down a ladder. This grotto is the richest of all the German caves in stalactites of every form. The passage to the third grotto is at first peculiarly difficult, compelling the visiter to advance on all fours; but it afterwards enlarges, exhibiting on its walls stalactites of the most fantastic shapes. From this vault there are two lateral dilatations which constitute the third and fourth grottoes. At the extremity of the passage it is requisite to re-ascend in order to reach the entrance of the proper third cavern, which opens out like a gateway. Beyond this third grotto there is said to be another passage terminating in two small caves.

Dr. Buckland, in his Reliquiæ Diluvianæ, has published an accurate account of this cave. The first or grand chamber is from forty to fifty feet in diameter, with stalactites on various parts of its roof. It is covered with a floor of diluvial loam, containing some bones and pebbles, and having on its surface a few fragments of stalagmite, left by the laborer, along with large blocks of limestone fallen from the roof. The intermediate expansion between the first grotto and the last or lower vault, is floored with a thick crust of stalagmitic spar, covering a large accumulation of loam and large pebbles, through which are dispersed great quantities of bears' bones. The lowest cavern is of a similar nature.

A second grotto, nearly as famous as the first, is situated at no great distance from it, and is called the unicorn's cave. It lies in the Duchy of Grubenhagen, on nearly the last southern slope of the Hartz Mountains. The entrance is ten feet high and 7 wide; there is a vertical descent of fifteen feet into a kind of vestibule, whose roof gradually slopes downwards till at the end of sixty paces, the visiter is obliged to crawl. After a long passage he meets succcessively with three or four

caverns, which the country people say extend nearly two leagues into the mountain. The bones taken from this depository belong to bears, the hyæna, and a tiger or lion. Dr. Buckland, who explored it, represents its roof as hung with stalactite; but much of the carpet of stalagmite as having been destroyed and removed by those who dug up the bones. Over the solid floor of the cave a bed of brown earth or diluvial loam is spread, interspersed with angular fragments and rounded pebbles of limestone, and a few remaining bones and teeth. The undermost vault still undisturbed is filled with the same *diluvium*, copiously stuffed with bones.

In Hungary there are similar bone caves, which the country people call dragon grottoes, from an idea that the osseous relics appertain to that fabulous animal: but they belong to the great cavern bear, *Ursus spelæus.*

The German caves, however, richest in bony relics are those of Franconia, of which Esper has given a detailed account. A valuable work on the same subject has been published more lately by Goldfuss, Professor of Natural History in Berne, entitled, *The Environs of Muggendorf.* The greater number of the grottoes here lie in a small peninsula, formed by the river Wiesent which falls into the Regnitz, a tract belonging to the great basin of the Mein. The principal cavern is called the Gaylenreuth, and lies without this kind of a peninsula, on the left bank of the Wiesent, to the northeast of the village from which it takes its name.

The floors of these grottoes are literally stuffed with teeth and bones. In a cave discovered in 1784, a great number of the bones of the hyæna and lion were found. The opening was much too narrow to have allowed these animals to have entered by it.

The relics found in the cavern of Gaylenreuth, are the most completely known, from the circumstance of having been examined by so many naturalists. Cuvier ascertained that three-fourths of the bones belong to bears, of two or three species of the genus; next to which are those of the hyæna, wolf, fox, glutton, polecat, or some kindred animal. He also observed some bones of *herbivora*, and particularly of stags, fragments of

which are now in the possession of Mr. Ebel, of Bremen. According to M. Rosenmüller there are likewise bones of men, horses, oxen, sheep, stags, roe-bucks, mules, badgers, dogs and foxes; but the whole of these are shown, by accurate inspection of their localities in the cavern, and their state of preservation, to have been deposited at a much more recent date than those of the bears, tigers and hyænas.

In the Geiss-Knok or Goat-cave, discovered in 1793 and situated not far from that last named, Rosenmüller found two human skeletons covered with stalactite: a process which may be accomplished in less than a century.

Numerous other caves, equally interesting as those here mentioned, have been described by naturalists. But what we have quoted, will prove sufficient for the present purpose, and for more extensive accounts, the reader is referred to Ure's Geology and other works on the same interesting science.

Not the least interesting part of the phenomena is that the more remarkable species of the bones are identical over a space of about 550 miles. Upwards of three-fourths belong to bears, whose species is no longer to be found in a living state. One half, or perhaps three-fourths of the remaining fourth, have been traced to a species of hyæna which is equally unknown at the present day; a smaller number may be referred to a species of the genus tiger or lion, and another to a species of the wolf or dog family; the smallest specimens proceed from various little carnivora, as the fox, pole-cat or kindred species.

Of course, at the time when these and similar caves formed dens for animals, the openings to them must have been much larger. The deposition of lime from the trickling of water containing it in solution, is continual, and in course of time the entrance to the grottoes will be altogther closed from this cause. Nothing can be said of the period of existence of the animals. Though recent, when compared with the era of the mastodon and its cotemporaries, yet thousands of years may have elapsed since their deposition.

All that geology can teach us, in fact, respecting the ages of the world is comparative. It can assign no dates to the revolutions which have occurred; to the extinction of one race of

animals, or to the existence of another. Its developements can only lead to a knowledge of the order of time in which they successively inhabited the earth.

Geoffroy St. Hilaire collected from the tombs and temples of Upper Egypt, as many animal mummies as he could. He brought home cats, ibises, birds of prey, dogs, apes, crocodiles and the head of a bull all embalmed,—for the Egyptians not only preserved the bodies of their own species, but of all kinds of animals,—and he could observe no greater difference between them and such as are now most familiar to us, than between human mummies and the skeletons of the modern races of men. Cuvier has proved that the ibis is now the same animal in every respect as it was in the days of the Pharaohs, upwards of 3,500 years ago.

It is with hope that we anticipate interesting results from an examination of the bone deposit in the state of Pennsylvania.

Jan. 27th. The preparation of a memoir of our late distinguished member, Mr. De Schweinitz, was now called up for consideration. It was then *Resolved*, That another member be appointed to carry into effect the resolution by which Dr. Rivinis was appointed.

The chairman then appointed Professor W. R. Johnson.

The resolution proposed by Professor W. R. Johnson, for creating a committee of physics, was then carried in the affirmative, the committee to be elected at the same time as the other standing committees.

The chairman then appointed Dr. Goddard, and W. P. Gibbons, as tellers; the latter resigned, Dr. Carson acted; who after a recess, reported the following gentlemen to be elected members of the standing committees.

Library.—A. L. Elwyn, M. D., Jacob Peirce, James Bryan, M.D., F. Turnpenny, M. D., and W. P. Gibbons.

Mineralogical.—J. P. Wetherill, R. E. Peterson, Jacob Peirce, H. D. Rogers, S. G. Morton, M. D.

Zoological.—S. G. Morton, M. D., Chas. Pickering, M. D., T. D. Mutter, M. D,, H. M'Murtrie, M. D., and J. K. Markland.

Ornithological.—T. M'Euen, M. D., P. B. Goddard, M. D., T. D. Mutter, M. D., E. Hallowell, M. D., T. A. Conrad.

Botanical.—C. Pickering, M. D., R. E. Griffith, M. D., S. Carson, M. D., P. B. Goddard, M. D.

Geological.—H. D Rogers, J. M. Keagy, M.D., S. G. Morton, M. D., T. M'Euen, M. D., R. E. Peterson.

Physics.—W. R. Johnson, A. D. Bache, C. M'Euen, J. Lukens, J. P. Wetherill.

PROCEEDINGS ON FISHING STATIONS, AND ANECDOTES CONNECTED WITH THE WHALE FISHERIES.

"On fishing stations, when the weather is such as to render the fishing practicable, the boats are always ready for instant service. Suspended from davits or cranes by the side of the ship, and furnished with the requisite implements, two boats at least, the crews of which are always in readiness, can, in a general way, be manned and lowered into the water, within the space of one minute of time.

"Wherever there is a probability of seeing whales, when the weather and situation are such as to prevent the possibility of capturing them, the crow's-nest, which is an apparatus placed on the main-topmast, or top-gallant-mast head, as a watch tower, is generally occupied by the master, or some one of the officers, who, commanding from thence an extensive prospect of the surrounding sea, keeps an anxious watch for the appearance of a whale; assisted by a telescope, he views

the operations of any ship which may be at sight at a distance; and occasionally sweeps the horizon with his glass, to extend the limited sphere of vision, in which he is able to discriminate a whale with the naked eye, to an area vastly greater. The moment that a fish is seen, he gives notice to the 'watch on deck,' part of whom leap into a boat, are lowered down, and push off towards the place. If the fish be large, a second boat is immediately despatched to the support of the other. When the whale again appears, two boats row towards it with their utmost speed; and though they may be disappointed in all their attempts, they generally continue the pursuit until the fish either takes the alarm, and escapes them, or they are recalled by signal to the ship. When two or more fish, appear at the same time in different situations, the number of boats sent in pursuit is commonly increased; and when the whole of the boats are sent out, the ship is said to have 'a loose fall.'

"During fine weather, in situations where whales are seen, or where they have recently been seen, or where there is a great probability of any making their appearance, a boat is generally kept in readiness, manned and afloat. If the ship sails with considerable velocity, this boat is towed by a rope astern; but when the ship is pretty still, whether moored to ice, laid to, or sailing in light winds, the 'bran boat,' as it is called, often pushes off to a little distance from the ship. A boat on watch commonly lies still in some eligible situation, with all its oars elevated out of the water, but in readiness in the hands of the rowers for immediate use.

"The harpooner and boat steerer keep a careful watch on all sides, while each of the rowers looks out in the direction of his oar. In field fishing, the boats approach the ice with their sterns, and are each of them fastened to it by means of a boat-hook, or an iron spike with a cord attached, either of which is held by the boat-steerer, and is slipped or withdrawn the moment a whale appears. There are several rules observed in approaching a whale, as precautions, to prevent as far as possible the animal from taking the alarm. As the whale is dull of hearing, but quick of sight, the boat-steerer always endeavors to get behind it; and, in accomplishing this, he is some-

times justified in taking a circuitous route. In calm weather, where guns are not used, the greatest caution is necessary before a whale can be reached; smooth careful rowing is always requisite, and sometimes sculling is practised.

"When it is known that a whale seldom abides longer on the water than two minutes, that it generally remains from five to ten or fifteen minutes under water; that in this interval it sometimes moves through a space of half a mile or more,—and that the fisher has very rarely any certain intimation of the place in which it will reappear; the difficulty and address requisite to approach sufficiently near, during its short stay on the surface, to harpoon it, will readily be appreciated. It is, therefore, a primary consideration with the harpooner always to place his boat as near as possible to the spot in which he expects the fish to rise, and he conceives himself successful in the attempt when the fish 'comes up within a start;' that is, within the distance of about 200 yards. In all cases when a whale that is pursued has but once been seen, the fisher is considerably indebted to what is called chance for a favorable position. But when the whale has been twice seen, and its change of place, if any, noticed, the harpooner makes the best use of the intimation derived from his observation on its apparent motion, and places his boat accordingly; thus he anticipates the animal in its progress, so that when it rises to the surface, there is probability of its being within the favorable precincts of a start.

"A whale moving forward at a small distance beneath the surface of the sea, leaves a sure indication of its situation, in what is called an 'eddy,' having somewhat the resemblance of the 'wake,' or track of a ship, and in fine calm weather its change of position is sometimes pointed out by the birds, many of which closely follow it when at the surface, and hover over it when below, whose keener vision can discover it, when it is totally concealed from human eyes. By these indications many whales have been taken.

"Whenever a whale lies on the surface of the water, unconscious of the approach of its enemies, the hardy fisher rows directly upon it; and an instant before the boat touches it, buries

his harpoon in its back. But if, while the boat is yet at a little distance, the whale should indicate his intention of diving, by lifting his head above its common level, and then plunging it under water, and raising his body until it appear like the large segment of a sphere,—the harpoon is thrown from the hand, or fired from a gun, the former of which, when skilfully practised, is efficient at the the distance of eight or ten yards, and the latter at the distance of thirty yards, or upwards. The wounded whale, in the surprise and agony of the moment, makes a convulsive effort to escape. Then is the moment of danger. The boat is subjected to the most violent blows from its head, or its fins, but particularly from its ponderous tail, which sometimes sweeps the air with such tremendous fury, that both boat and men are exposed to one common destruction.

"The head of the whale is avoided, because it cannot be penetrated with the harpoon; but any part of the body, between the head and tail, will admit of the full length of the instrument, without danger of obstruction. The harpoon, therefore, is always struck into the back, and generally well forward towards the fins, thus affording the chance, when it happens to drag and plough along the back, of retaining its hold during a longer time, than when struck in closer to the tail.

"The moment the wounded whale disappears, or leaves the boat, a jack or flag, elevated on a staff, is displayed; on sight of which, those on watch in the ship, give the alarm, by stamping on the deck, accompanied by a simultaneous and continued shout of 'a fall,' at the sound of this, the sleeping crew are roused, jump from their beds, rush upon the deck, with their clothes tied by a string in their hands, and crowd into boats, with a temperature of zero. Should a fall occur, the crew would appear upon deck, shielded only by their drawers, stockings, and shirts, or other habiliments in which they sleep. They generally contrive to dress themselves, in part at least, as the boats are lowered down; but sometimes they push off in the state in which they rise from their beds, row away towards the "fast boat," and have no opportunity to clothe themselves for a length of time afterwards. The alarm of a 'fall,' has a singular effect on the feelings of a sleeping person, unaccus-

tomed to the whale-fishing business. The first effort of a 'fast-fish,' or whale that has been struck, is to escape from the boat, by sinking under water. After this, it pursues its course directly downwards, or re-appears at a little distance, and swims with great celerity, near the surface of the water, towards any neighboring ice, among which it may obtain an imaginary shelter; or it returns instantly to the surface, and gives evidence of its agony, by the most convulsive throes, in which its fins and tail are alternately displayed in the air, and dashed into the water with tremendous violence. The former behaviour, however, that is, to dive towards the bottom of the sea, is so frequent, in comparison of any other, that it may be considered as the general conduct of a fast fish.

"A whale struck near the edge of any large sheet of ice, and passing underneath it, will sometimes run the whole of the lines out of the boat, in the space of eight or ten minutes of time. This being the case, when the "fast-boat" is at a distance, both from the ship and from any other boat, it frequently happens that the lines are all withdrawn before assistance arrives, and with the fish, entirely lost. In some cases, however, they are recovered. To retard, therefore, as much as possible, the flight of the whale, it is usual for the harpooner who strikes it, to cast one, two, or more turns of line round a kind of post called a bollard; which is fixed within ten or twelve inches of the stem of the boat, for the purpose. Such is the friction of the line, when running round the bollard, that it frequently envelopes the harpooner in smoke; and if the wood were not repeatedly wetted, would probable set fire to the boat. During the capture of one whale, a groove is sometimes cut in the bollard, near an inch in depth; and, were not for a plate of brass, iron, or a block of lignum-vitæ, which covers the top of the stem where the line passes over, it is apprehended that the action of the line on the material of the boat, would cut it down to the water's edge, in the course of season of successful fishing. The approaching distress of a boat, for want of line, is indicated by the elevation of an oar, in the way of a mast, to which is added a second, a third, or even a fourth, in proportion to the nature of the exigence. The utmost care and attention are requisite

on the part of every person in the boat, when the lines are running out, fatal consequences having been sometimes produced, by the most trifling neglect. When the line happens 'to run foul,' and cannot be cleared on the instant, sometimes draws the boat under water; on which, if no auxiliary boat, or convenient piece of ice be at hand, the crew are plunged into the sea, and are obliged to trust to the buoyancy of their oars, or to their skill in swimming, for supporting themselves on the surface. To provide against such an accident, as well as to be ready to furnish an additional supply of lines, it is usual, when boats are sent in pursuit, for two to go out in company; and when a whale has been struck, for the first assisting boat which approaches, to join the fast-boat, and to stay by it until the fish re-appears. The other boats, likewise, make towards the one carrying a flag, and surround it at various distances, awaiting the appearance of the wounded whale.

"On my first voyage to the whale-fishery, such an accident, as above alluded to, occurred. A thousand fathoms of line were already out, and the fast-boat was forcibly pressed against the side of a piece of ice. The harpooner, in his anxiety to retard the flight of the whale, applied too many turns of the line round the bollard, which, getting entangled, drew the boat beneath the ice. Another boat, providentially was at hand, into which the crew, including myself, who happened to be present, had just time to escape. The whale with near two miles length of line, was in consequence of the accident, lost, but the boat was recovered. On a subsequent occasion, I underwent a similar misadventure but with a happier result; we escaped with a little wetting into an accompanying boat, and the whale was afterwards captured, and the boat with its lines recovered.

"When fish have been struck by myself, I have on different occasions estimated their rate of descent. For the first 300 fathoms, the average velocity was usually after the rate of eight to ten miles per hour. In one instance, the third line of 120 fathoms was run out in 61 seconds; that is at the rate of $8\frac{1}{8}$ English miles, or $7\frac{1}{8}$ nautical miles per hour. By the motions of the fast-boat, the simultaneous movements of the whale are estimated. The auxiliary boats, accordingly, take their stations

about the situation where the whale, from these motions, may reasonably be expected to appear.

"The average stay under water, of a wounded whale, which steadily descends after being struck, according to the most usual conduct of the animal, is about 30 minutes. The longest I ever observed was 56 minutes; but in shallow water, I have been informed, it has sometimes been known to remain an hour and a half at the bottom after being struck, and yet has returned to the surface alive. The greater the velocity, the more considerable the distance to which it descends; and the longer the time it remains under water, so much the greater in proportion is the extent of its exhaustion and the consequent facility of accomplishing its capture. Immediately that it reappears, the assisting boats make for the place with their utmost speed, and as they reach it, each harpooner plunges his harpoon into its back, to the amount of three, four, or more, according to the size of the whale, and the nature of the situation. Most frequently, however, it descends for a few minutes after receiving the second harpoon, and obliges the other boats to await its return to the surface, before any further attack can be made. It is afterwards actively plied with lances, which are thrust into its body, aiming at its vitals. At length, when exhausted by numerous wounds and the loss of blood, which flows from the huge animal in copious streams, it indicates the approach of its dissolution, by discharging from its "blowholes," a mixture of blood along with the air and mucus which it usually expires, and finally jets of blood alone. The sea, to a great extent around, is dyed with its blood, and the ice, boats, and men, are sometimes drenched with the same. Its track is likewise marked by a broad pellicle of oil, which exudes from its wounds, and appears on the surface of the sea. Its final capture is sometimes preceded by a convulsive struggle, in which its tail, reared, whirled, and violently jerked in the air, resounds to the distance of miles. In dying, it turns on its back or on its side, which joyful circumstance is announced by the capturers with the striking of their flags, accompanied by three lively huzzas!

"The remarkable exhaustion observed in the first appearance of a wounded whale at the surface, after a descent of 700 or

800 fathoms perpendicular, does not depend on the nature of the wound it has received; for a hundred superficial wounds received from harpoons, could not have the effect of a single lance penetrating the vitals, but is the effect of the almost incredible pressure to which the animal must have been exposed. The surface of the body of a large whale, may be considered as comprising an area of 1540 square feet. This, under the common weight of the atmosphere only, must sustain a pressure of 3,104,640 pounds, or 1386 tons. But at the depth of 800 fathoms, where there is a column of water equal in weight to about 154 atmospheres, the pressure on the animal must be equal to 211,200 tons.* This is a degree of pressure of which we can have but an imperfect conception. It may assist our comprehension, however, to be informed, that it exceeds in weight sixty of the largest ships of the British navy when manned, provisioned, and fitted for a six months' cruise.

"Every boat fast to a living whale carries a flag, and the ship to which such boats belong, also wears a flag, until the whale is either killed or makes its escape. These signals serve to indicate to surrounding ships the exclusive title of the "fast ship," to the entangled whale, and to prevent their interference excepting in the way of assistance, in the capture.

"A very natural inquiry connected with this subject, is what is the length of time requisite for capturing a whale? This is a question which can only be answered indirectly; for I have witnessed the capture of a large whale, which has been effected in twenty-eight minutes; and have also been engaged with another fish which was lost, after it had been entangled about sixteen hours. Instances are well authenticated, in which whales have yielded their lives to the lances of active fishers,

"* From experiments made with sea water, taken up near Spitzbergen, I find that 35 cubical feet weigh a ton. Now supposing a whale to descend to the depth of 800 fathoms, or 4,800 feet, which I believe is not uncommon, we have only to divide 4,800 feet, the length of the column of water pressing upon the whale, by 35 feet, the length of a column of sea water a foot square, weighing a ton, the quotient 137 1-7, shows the pressure per square foot upon the whale in tons; which multiplied by 1540, the number of square feet of surface exposed by the animal, affords a product of 211,200 tons, besides the usual pressure of the atmosphere."

within the space of fifteen minutes from the time of being struck; and in cases when fish have been shot with a harpoon-gun, in a still shorter period: while other instances are equally familiar and certain, wherein a whale having gained the shelter of a pack or compact patch of ice, has sustained or avoided every attack upon it, during the space of forty or fifty hours. Some whales have been captured when very slightly entangled with a single harpoon, while others have disengaged themselves, though severely wounded with lances, by a single act of violent and convulsive distortion of the body, or tremendous shake of the tail, from four or more harpoons; in which act, some of the lines have been broken with apparent ease, and the harpoons, to which other lines where attached, either broken or torn out of the body of the vigorous animal. Generally, the speedy capture of a whale depends on the activity of the harpooners, the favorableness of situation and weather, and in no inconsiderable degree on the peculiar conduct of the whale attacked. Under the most favorable circumstances, namely, when the fishermen are active, the ice very open, or the sea free from ice and the weather fine,—the average length of time occupied in the capture of a whale, may be stated as not exceeding an hour. The general average, including all sizes of fish, and all circumstances of capture, may probably be two or three hours.

"The method practised in the capture of whales, under favorable circumstances, is very uniform with all the fishers, both British and foreigners. The only variation observable in the proceedings of different fishers, consisting in a degree of activity and resolution displayed, in pursuance of the operations of harpooning and lancing the whale, and in the address manifested in improving by any accidental movement of the fish, which may lay it open to an effectual attack,—rather than in any thing different or superior in the general method of conducting the fishery. It is true, that with some the harpoon-gun is much valued, and used with advantage, while with others, it is held in prejudiced aversion; yet, as this difference of opinion effects only the first attack and entanglement of the whale, the subsequent proceedings with all the fishers, may still be said to be

founded on equal and unanimous principles. Hence, the mode described in the preceding pages, of conducting the fishery for whales, under favorable circumstances, may be considered as the general plan pursued by all the fishers of all the ports of Britain, as well as those of the nations who resort to Spitzbergen. Neither is there any difference in the plan of attack, or mode of capture between fish of large size, and those of lesser growth; the proceedings are the same, but, of course, with the smaller less force is requisite; though it sometimes happens, that the trouble attached to the killing of a very small whale, exceeds that connected with the capture of one of the largest individuals. The progress or flight of a large whale cannot be restrained; but that of an under size fish may generally be confined within the limits of 400 to 600 fathoms of line. A full grown fish generally occupies the whole, or nearly the whole of the boats belonging to one ship in its capture; but three, four, or sometimes more small fish, have been killed at the same time, by six or seven boats. It is not unusual for small whales to run downward, until they exhaust themselves so completely, that they are not able to return to the surface, but are suffocated in the water. As it is requisite that a whale that has been drowned should be drawn up by the line, which is a tedious and troublesome operation, it is usual to guard against such an event by resisting its descent with a light strain on the line, and also by hauling upon the line, the moment its descent is stopped, with a view of irritating the wound, and occasioning such a degree of pain, as many induce it to return to the surface, where it can be killed and secured without further trouble. Seldom more than two harpoons are struck into an under size whale.

"The ease with which some whales are subdued, and the slightness of the entanglement by which they are taken, is truly surprising; but with others it is equally astonishing, that neither line nor harpoon, nor any number of each, is sufficiently strong to effect their capture. Many instances have occurred where whales have escaped, from four, five, or even more harpoons, while fish, equally large, have been killed through the medium of a single harpoon. Indeed, whales have been taken in con-

sequence of the entanglement of a line, without any harpoon at all; though, when such a case has occurred, it has evidently been the result of accident. The following instances are in point.

A whale was struck from one of the boats of the ship Nautilus, in Davis' Straits. It was killed, and as is usual after the capture, it was disentangled of the line connected with the "first fast-boat," by dividing it at the splice of the foreganger, within eight or nine yards of the harpoon. The crew of the boat from which the fish was struck, in the meantime were employed in heaving in the lines, by means of a winch fixed in the boat for the purpose, which they progressively effected for some time. On a sudden, however, to their great astonishment, the lines were pulled away from them, with the same force and violence, as by a whale when first struck. They repeated their signal, indicative of a whale being struck; their shipmates flocked towards them, and while every one expressed a similar degree of astonishment with themselves, they all agreed that a fish was fast to the line. In a few minutes, they were agreeably confirmed in their opinion, and relieved from suspense, by the rising of a large whale close by them, exhausted with fatigue, and having every appearance of a fast-fish. It permitted itself to be struck by several harpoons at once, and was speedily killed. On examining it after death, for discovering the cause of such an interesting accident, they found the line, belonging to the above mentioned boat, in its mouth, where it was still firmly fixed by the compression of its lips. The occasion of this happy and puzzling accident, was therefore solved;—the end of the line, after being cut from the whale first killed, was in the act of sinking in the water; the fish in question, engaged in feeding, was advancing with its mouth wide open, and accidentally caught the line between its extended jaws;—a sensation so utterly unusual as that produced by the line, had induced it to shut its mouth and grasp the line, which was the cause of its alarm, so firmly between its lips, as to produce the effect just stated. This circumstance took place many years ago, but a similar one occurred in the year 1814.

A harpooner, belonging to the Prince of Brazil, of Hull, had

struck a small fish. It descended, and remained for some time quiet, and at length appeared to be drowned. The strain on the line being then considerable, it was taken to the ship, with a view of heaving the fish up. . The force requisite for performing this operation, was extremely various; sometimes, the line came in with ease, at others, a quantity was withdrawn with great force and rapidity. As such, it appeared evident that the fish was yet alive. The heaving, however, was persisted in, and after the greater part of the line had been drawn on board, a dead fish appeared at the surface, secured by several turns of the line round its body. It was disentangled with difficulty, and was confidently believed to be the whale they had struck. But when the line was cleared from the fish, it proved to be merely the "bight," for the end still hung perpendicularly downward. What was then their surprise to find that it was still pulled away with considerable force. The capstern was again resorted to, and shortly afterwards, they hove up, also dead, the fish originally struck, with the harpoon still fast. Hence it appeared, that the fish first drawn up, had got accidentally entangled with the line, and in its struggles to escape, had still further involved itself, by winding the line repeatedly round its body. The first fish entangled, as was suspected, had long been dead; and it was this lucky interloper, that occasioned the jerks and other singular effects observed on the line.

MISCELLANIA.

1. *The American Aloe.*—AGAVE *Americana.*—It is a common opinion that this plant blossoms but once in a 100 years. But this is not a fact; the periods of its flowering depend on the rapidity of its growth and the climate in which it is placed. Thus in hot countries, where it grows fast and expands many leaves every season, it will bloom every year or two. But in colder climates where its growth becomes slow, much longer time must elapse before its stem shoots up. When vigorous, the stem usually grows to more than twenty feet in height. One of the highest of which we have any account, was in the king of Prussia's garden, and reached forty feet. The plant was first known to bloom in England in 1729 in the garden of a Mr. Cowell, at Hoxton near London. Another bloomed in 1737 at Eaton Hall, in Chesire, of which there is a print, and by the inscription on it, the stem bud appeared on the fifteenth of June, and grew five inches a day for some weeks. The flower branches were perfected in twelve weeks and then ceased to grow for a month; while the buds were forming. It produced 1050 flowers. One that bloomed at Leyden in 1760 produced more than 4000 flowers.

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2. *Instinct of the Polar bear for the preservation of her young.* Though the voracity of the Polar bear is such as frequently to lead them to feed on their own species, yet maternal tenderness towards their offspring is often exhibited in a very remarkable manner. There is no danger that they will not brave, no exertion that they will not use for their defence and assistance. Scoresby relates an anecdote of a bear with her two cubs, being pursued by some sailors across a field of ice, and finding that neither by example nor by a peculiar voice and action she could urge them to the requisite speed, applied her paws and pitched them alternately forward. The little creatures apparently conscious of their danger, threw themselves before their mother to receive the impulse, by which means they all effected their escape.

3. *Strength and speed of the Esquimaux dogs.*—The Arctic dog in general, is observed to bear a strong resemblance to the wolf, and the opinion is prevalent that they are neither more nor less than tamed wolves: yet from the avidity with which the wolf devours these, his supposed tamed brethren, it does not seem that he is desirous of claiming the affinity. While the dogs are in a state of infancy, the Esquimaux women exhibit great tenderness toward them, often taking the young puppies into bed, and feeding them from their own mouths. As soon as they can walk, they are yoked to a sledge; and in endeavoring to shake off the incumbrance they learn to draw it. Severe and frequent beatings, however, are necessary to train them for acting as a regular team. According to Parry, three dogs could draw a sledge weighing a 100 lbs., at the rate of a mile in six minutes; and one leader has drawn 196 lbs. the same distance in eight minutes. A full team, however, comprises eight or ten dogs; though seven have drawn a full sledge at the rate of a mile in four and a half minutes; while nine, in conveying stores from the Hecla to the Fury, drew 1611 lbs. in nine minutes. Capt. Lyon speaks of a team which he formed, that used to draw from ship to ship, a mile distant, in the deepest darkness and amid clouds of snow drifts, with the most perfect precision, where he could not have found his way for a hundred steps.

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4. *Importance of a knowledge of Natural Philosophy.* In illustration of the importance of being acquainted with the philosophy of the atmosphere, the following anecdote is given in "Dick, on the improvement in society."

A respectable gentleman of landed property, in one of the middle counties of Scotland, applied to a friend of mine, a lecturer on Chemistry and Natural Philosophy, in order to obtain his advice respecting a pump-well which he had lately constructed at considerable expense. He told him, that, notwithstanding every exertion, he could not obtain a drop of water from the spout, although he was quite sure there was plenty of water in the well, and *although he had plastered it all around, and blocked up every crevice.* When my friend inspected the pump,

he suspected that the upper part of the well was air-tight, and consequently, that the atmospheric pressure could not act on the surface of the water in the well. He immediately ordered a hole to be bored adjacent to the pump, when the air rushed in with considerable force; and, on pumping, the water flowed copiously from the spout. The gentleman was both overjoyed and astonished; but it is somewhat astonishing that neither he nor his neighbors, nor any of the workmen who had been employed in its construction, should have been able to point out the cause of the defect; but, on the other hand, should have taken the *very opposite* means for remedying it, namely, by plastering up every crevice, so as to produce a kind of vacuum within the well. This and similar facts show how little progress scientific knowledge has yet made, even among the middle classes of the community.

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5. *Singular Anecdote of the American Jaguar.*—Of this ferocious animal, which is so numerous along the banks of the Orinoco, that they go into the Indian villages and devour the pigs of the poor natives, a missionary related to Humboldt the following anecdote:

"Two Indian children, a boy and girl, eight or nine years of age, were sitting among the grass near the village of Atures, in the midst of a savanna. It was two in the afternoon when a jaguar issued from the forest and approached the children, gamboling around them; sometimes concealing itself among the long grass, and again springing forward, with his back curved and his head lowered, as is usual with our cats. The little boy was unaware of the danger in which he was placed, and became sensible of it only when the jaguar struck him on the head with one of his paws. The blows thus inflicted were at first slight, but gradually became ruder. The claws of the jaguar wounded the child, and blood flowed with violence. The little girl then took up the branch of a tree and struck the animal, which fled before her. The Indians, hearing the cries of the children, ran up and saw the jaguar, which bounded off without showing any disposition to defend itself."—"What," asks Humboldt, "meant this fit of playfulness in an animal

which, although not difficult to be tamed in our menageries, is always so ferocious and cruel in the state of freedom? If we choose to admit that, being sure of its prey, it played with the young Indian as the domestic cat plays with a bird, the wings of which have been clipped, how can we account for the forbearance of a large jaguar when pursued by a little girl? If the jaguar was not pressed by hunger, why should it have gone up to the children? There are mysteries in the affections and hatreds of animals. We have seen lions kill three or four dogs which were put into their cage, and instantly caress another which had the courage to seize the royal beast by the mane. Man is ignorant of the sources of these instincts. It would seem that weakness inspires more interest the more confiding it is."

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6. *Customs of the Choctaws in burying their dead.*—Bartram gives the following curious account of the manner in which this race of Indians proceed in paying the last duties to the dead:

As soon as a person is dead, they erect a scaffold eighteen or twenty feet high, in a grove adjacent to the town, where they lay the corpse, lightly covered with a mantle; here it is suffered to remain, visited and protected by the friends and relations, until the flesh becomes putrid, so as easily to part from the bones; then undertakers, who make it their business, carefully strip the flesh from their bones, wash and cleanse them, and when dry and purified by the air, having provided a curiously wrought chest or coffin, fabricated of bones and splints, they place all the bones therein; which is deposited in the bone-house, a building erected for that purpose in every town. And when this house is full, a general solemn funeral takes place. When the nearest kindred or friends of the deceased, on a day appointed, repair to the bone-house, take up the respective coffins, and following one another in order of seniority, the nearest relations and connexions attending their respective corpse, and the multitude following after them, all as one family, with united voice of alternate Allelujah and lamentation, slowly proceeding on to the place of general interment, where they place

the coffins in order, forming a pyramid; and lastly, cover all over with earth, which raises a conical hill or mound. When they return to town in order of solemn procession, concluding the day with a festival, which is called the feast of the dead.

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7. *Cotton seed oil.* This article is becoming of importance in our southern cities. A manufactory of it is established at Mobile and another at Natchez. It is said to afford as good light as the best sperm oil, and sells at $1.20 per gallon by the quantity.

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8. *Longevity of the Vine.*—The vine lasts to a considerable age; it spreads also to a large extent, or, when supported, rises to a great height. Although it bears at three or four years plentifully, it is said by Miller that vineyards improve in quality till fifty years old. Pliny mentions a vine which had attained the age of six hundred years. In France and Italy there are entire vineyards still in existence, and in full bearing, which were in the same condition at least three centuries ago, and have so continued ever since. The slender stems of ordinary vines, when they have attained a considerable age, are remarkably tough and compact; and the timber of the very old ones in foreign countries, which is occasionally of size enough for being sawn into planks, and being made into furniture and utensils, is almost indestructible. Strabo mentions an old vine which two men could not embrace. A single vine plant, which was trained against a row of houses at Northallerton, covered, in 1785, one hundred and thirty-seven square yards. It was then about a hundred years old, and it increased in size afterwards; but it is now dead. In 1785, the principal stem of this vine was about fifteen inches in diameter.

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9. *Caribs.*—On arriving at the village of Cari, Humboldt found more than 500 Caribs in the hamlet, and saw many more at the surrounding missions. They were of large stature, from five feet nine to six feet two. The men had the lower part of the body wrapped in a piece of dark blue cloth, while the women had merely a narrow band. This race differs from the

other Indians, not only in being taller, but also in the greater regularity of their features, in having the nose less flattened, and the cheek-bones less prominent. The hair of the head is partially shaven, only a circular tuft being left on the top,—a custom that might be supposed to have been borrowed from the monks, but which is equally prevalent among those who have preserved their independence. Both males and females are careful to ornament their persons with paint. The Caribs, once so powerful, now inhabit but a small part of the country which they occupied at the time when America was discovered. They have been exterminated in the West India Islands and the coasts of Darien, but in the provinces of New Barcelona and Spanish Guiana have formed populous villages, under the government of the missions. Humboldt estimates the number inhabiting the llanos of Piritoo and the banks of the Caroni and Cuyuni at more than 35,000; and the total amount of the pure race at 40,000.

The missionary led the travellers into several huts, where they found the greatest order and cleanliness, but were shocked by the torments that the women inflicted on their infants, for the purpose of raising the flesh in alternate bands from the ankle to the top of the thigh; a practice which the monks had in vain attempted to abolish. This effect was produced by narrow ligatures, which seemed to obstruct the circulation of the blood, although it did not weaken the action of the muscles. The forehead, however, was not flattened, but left in its natural form.